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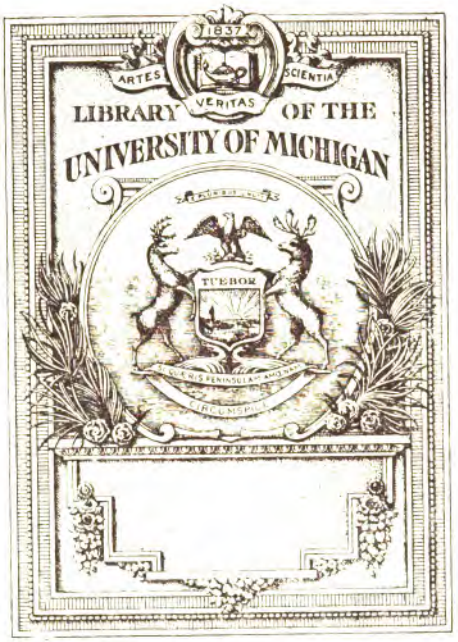
ggestions and Exercises for Manual Training

By the State Superintendent of Public Instruction of Michigan, 1905.



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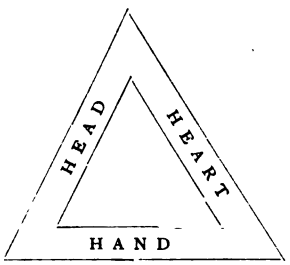
SUGGESTIONS AND EXERCISES

FOR

MANUAL TRAINING



BY

PATRICK H. KELLEY
State Superintendent of Public Instruction

August 1905

LANSING, MICHIGAN
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1905

Man without tools is nothing; with tools he is all.—Carlyle.

The great gulf between the savage and the civilized man is spanned by the seven hand tools—the axe, the saw, the plane, the hammer, the square, the chisel, and the file.—Charles H. Ham.

James Watt conferred upon his country more solid benefits than all the treaties she ever made and all the battles she ever won.—Dr. Draper.

For the most significant fact in all the realm of certitude is the fact that man impresses himself upon nature through the hand alone.—President Eliot.

Put a sword into the hand and it will fight, a plow and it will till, a harp and it will play, a pencil and it will paint, a pen and it will speak. What, moreover, is a ship, a railway, a lighthouse, a palace,—what indeed, is a whole city, a whole continent of cities, all the cities of the globe nay the very globe itself, so far as man has changed it, but the work of a giant hand with the human race, acting as one mighty man, has executed his will.—George Wilson, M. D., F. R. S., C. E.

REFERENCE BOOKS.

Paper and scissors in the school room—Weaver—Thomas Charles & Co., Chicago.
Paper folding—Hammel—B. F. Johnson & Co., Richmond, Va.
Cardboard construction—Trybon—Bradley & Co., Chicago.
Varied occupations in string work—Walker—McMillan & Co., N. Y.
Basket making—Thomas Charles & Co., Chicago.
How to make baskets—White—Doubleday & Co., N. Y.
How to do it—basket making—Art Craft Supply Co., Chicago.
Varied occupations in weaving—Walker—McMillan & Co., N. Y.
Hand loom weaving—Todd—Rand, McNally & Co., Chicago.
Raffia and reed weaving—Knapp—Thomas Charles & Co., Chicago.
Home and school sewing—Patton—Newson & Co., Chicago.
School needlework—Hapgood—Ginn & Co., Chicago.
Elementary knife work—B. F. Johnson & Co.
Advanced knife work—B. F. Johnson & Co.
Busy work—Kellogg—E. L. Kellogg, N. Y.
Industrial school education—Baldwin—Thomas Charles & Co., Chicago.
Rural agriculture, bulletin No. 1—McGill—Warner Co., St. Paul, Minn.

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Manual Training.

The expression "manual training" ordinarily signifies systematic training in any work with special reference to developing the accessory hand muscles and perfecting their co-ordination with the brain and nerves. This meaning, however is being gradually expanded to mean more than hand muscles. In a general way it may include all those systematic exercises by which is secured the co-ordination of brain, nerve, and muscle, thus producing muscular control and accuracy of the senses. In short, we might assume the general thought of manual training in one general proposition as exercises for the development of the power to experience close and accurate relation with the material universe.

With the experienced teacher it needs no argument to prove that accuracy in either mental operations or physical manipulations can be accomplished only by concentration of mind. But concentration of mind is one of the basic essentials for strength of intellect. Hence manual training with its necessity for accuracy holds within itself one of the most important of all educative elements, for without the power to concentrate there can be no intellectual supremacy. Indeed, someone has said that the measure of intellectual power is simply the measure of the power of concentration. If manual training possesses such value in the educative process it is the teacher's duty to make use of it whenever and wherever possible.

These same exercises express an idea in material form, in other words the pupil makes something. This compels him to first assemble his subconscious, hazy concepts into a clear and definite picture of the thing in mind,—more concentration. He must then organize his work and step by step work out the project. This develops his power of initiative, crystallizes his imagination and compels a logical sequence of thought and procedure. He thinks things through; he "sees the end from the beginning;" his thinking becomes systematic, and systematic thinking gives mental power.

CHARACTER BUILDING.

Manual training is also a powerful factor in the building of character, developing as it does perseverance, self-reliance, originality, and individuality, those sturdy elements of character so necessary to success in life.

The ordinary grade pupil cannot see the disastrous effects of incorrect computations in arithmetic, and therefore he must be driven to that repetition of work necessary for the habit of accuracy. But he *can* see the crooked line, the imperfect curve, the open joint, and in consequence he can appreciate the necessity of repeated attempts until a degree of perfection and accuracy is attained. He thus develops perseverance, and when after various trials a "tight" joint has been made, he begins to sense his individual power to do things; self-reliance begins to assert itself; and a readiness as a consequence is shown to undertake tasks no matter how difficult.

INDIVIDUALITY.

Again, every teacher must have felt many times the antagonism of the school to the originality and individuality of the pupil. On the day that the five-year-old leaves his home of freedom, where originality and individuality have to a large degree been nurtured, and enters school we begin to take him out of himself and force him to build for himself a prison with the walls of form and habit. He has been for five years or more doing things in his own way. He runs, jumps, laughs, cries, talks, thinks, and acts with an abandon born of his own divine individuality, and how interesting it is! The first lesson in school, however, begins to teach him to bind himself with bands. He must not talk aloud, nor laugh aloud, nor cry, but must stand, walk, and talk according to certain instructions. He must read, spell, and cipher according to the book, and a teacher who can bring her class of forty distinct individualities to seem the most like a machine with no individuality is often rated as a good teacher. Someone has said "Nature covers her face and weeps whenever she beholds a schoolhouse." Now, we do not say that this condition can be entirely changed. To a degree the teaching of children in masses must bring about these results. Every teacher, however, should welcome the opportunity to relieve it even in a small measure. Manual training offers much opportunity for originality, both in design, proportion, and coloring, thus giving individuality a breath at least of life. There are many other minor reasons growing out of these fundamental propositions which argue for the introduction of manual training in all school work.

PROLONGATION OF SCHOOL LIFE.

There is another, an economic question, involved in this work It has been demonstrated beyond any possibility of doubt that older pupils, boys especially, are not so anxious to drop out of those schools where manual training is taught. They see in it something that may touch their lives in the future. The relation of algebra, geometry, Latin, and kindred subjects to the necessities of every day life cannot be so readily seen and consequently when they reach that stage of young manhood or young womanhood from which they begin to look over into real life they get restless, lose interest, and usually leave school. But if such young men and young women can be kept in school by manual training they will learn not only manual training and receive the benefits involved therein but in connection with the subject they would also be taught something of other higher branches and thus their higher powers of thought, which are ordinarily untouched owing to their youth and the subjects taught in the lower grades of school work, would be developed. This alone is a powerful argument in favor of the introduction of some phase of manual training in all schools.

Manual training is also an element of safety in our social life. The more of it a young person does in a systematic manner the more he touches real life; the young man, industrial life and the young woman, domestic life. This touch creates an understanding of and sympathy with labor thus bridging a deep and widening chasm in this country.

RELATION BETWEEN THE MANUAL AND THE MENTAL.

It is not the purpose of this discussion to analyze the psychological relation between manual activity and mental growth. That such relation

exists there can be little if any doubt. We do not remember any expert artisan who was not possessed of some especially marked mental qualities. Whether the qualities were the parents or the children of manual skill need not be considered. That they usually accompany each other is sufficient evidence to our mind that they are to a degree mutually helpful in the development each of the other. Certainly there is no manual skill without brain power. No idiot was ever a skilled workman and we believe it has been demonstrated to the satisfaction of all educators that, although somewhat mysterious, the training of the hand has a powerful influence upon the mental activity and intellectuality of the growing child. We believe further that the Baconian theory, "the study of things instead of words," was no greater discovery in the process of mental development than the "handling of things instead of the study of books" is in the process of methods of teaching.

The purpose of this introduction is to call attention to the educative value and necessity for manual training in the education of every child. We said the *necessity* and that is what is meant, for to our mind no person can approach the condition of full manhood without somewhere having had a manual training side to his education. The abject helplessness of the average child in the presence of new conditions is pitiable. The so-called educated man or woman without momentum, without initiative or executive power, the people who stand limp and helpless in the presence of the shifting problems of life, are examples of the one-sided education which manual training would complete. The boy who has been obliged to make things for himself is a monarch beside the one who has had things ready-made provided.

FAR-REACHING BENEFITS.

It must not be thought that manual training is beneficial to boys alone. Inasmuch as in the nature of things the industrial life of this nation must be developed, superintended, and wrought out largely by its men, we naturally speak first of the boys and of the shop. But the educational benefits are as important for girls as for boys. As home-makers the girls stand for as much in the future of the country as do the boys industrially. The artistic in the industrial world calls for the artistic in the home, and the girls must prepare to meet the new demands which the future will surely bring. They do not have the time to learn the household arts in the home, as did their mothers. Nine or ten months of each year they must be in school. The demands made by the school leave no time for household duties, especially such as involve handwork and art. The family food would be better prepared, and more economically used, the home be more tastily decorated and kept, the atmosphere of refinement and art more manifest, if the girls could have the practical touch with real things which manual training should give.

ORIGIN.

The idea of manual training and its necessity in schools has been a rapidly growing one. The first thought of it in the public schools of this country was probably generated from the Russian manual training exhibit at the Centennial Exhibition in Philadelphia in 1876, and the first distinctively manual training school in this country was not a fact until the establishment of such a school in St. Louis in 1879. Baltimore, Chicago, Eau Claire, Toledo, New York, Philadelphia, Denver, and Cleveland

followed between that year and the year 1886. From that time until the present the growth has been remarkably rapid. The report of the United States Commissioner of Education for 1900 names 322 cities in the United States having manual training as a part of its public school system. This is over fifty per cent of the cities of the United States with a population of 8,000 or more. This remarkable growth shows conclusively that the public is rapidly coming to demand the introduction of manual training into the public schools, for theorize as we will our intuitions insist that the culminating point of education is action, and action for the good of man.

Other countries have given much attention to manual training as a part of the public school system. One of the most notable investigations of recent years was made by a commission appointed in 1897 by the Lord Lieutenant of Ireland, composed of fourteen of the most eminent men in Ireland. They held ninety-three meetings, taking evidence of one hundred and eighty-six persons, and visited 119 manual training schools in Germany, France, Switzerland, Holland, Belgium, England, and Scotland. After two years of investigation their report was made, from which we quote some recommendations:

"We recommend that a course of woodwork, based on the lines of the Swedish system, with such modifications as the experience of other countries, especially of England and of Scotland, has shown to be useful, should at once be introduced into the program of the National Education Board. It will obviously be necessary for the board in this case, as in the case of the hand and eye training courses, to secure the services of competent organizers having practical experience in the work.

"We do not consider that woodwork should be made a compulsory subject.

"We recommend that provision should at once be made for the introduction of courses of hand and eye training in the Irish national schools." (By hand and eye training is meant paper cutting, folding, cardboard work, clay modeling, accompanied by drawing.) "Such exercises obviously have special utility in forming a natural link between kindergarten occupations in the infants' classes and exercises such as those in woodwork, in the higher classes in the school. But we consider that their value is practically independent of this, and that they may be introduced with great advantage into schools where, from any cause, they may neither have been preceded by the kindergarten occupations, on the one hand, nor be followed by more highly developed manual instruction, such as that in woodwork, on the other.

"We regard cookery as a most important branch of practical instruction. We are of opinion that this useful subject should be encouraged in the schools. Instruction might in many cases be given by special teachers in centers where the classes could be attended by the pupils from schools in the immediate neighborhood; in others the instruction in this subject must be given by the ordinary school teacher. In the latter case special provision must be made for the training of the teachers by itinerant teachers or otherwise. We consider that the teaching of this subject should be continuous, not in the sense that it should be taught every day, but that it should be taught in one or more classes each week, throughout the year or a considerable part of it. The practical lessons should be supplemented by lessons in theory and both should be interdependent. * * *"

"We may at once express our strong conviction that manual and prac-

tical instruction ought to be introduced as far as possible, into all schools where it does not at present exist, and that, into those schools where it does exist, it ought to be largely developed and extended. We are satisfied that such a change will not involve any detriment to the literary education of the pupils, while it will contribute largely to develop their faculties, to quicken their intelligence, and to fit them better for their work in life."

PURPOSE OF THIS PAMPHLET.

The specific purpose of this pamphlet is to aid, if possible, in the introduction of manual training in some of its simpler and inexpensive forms into the smaller graded schools of Michigan. It is unfortunate that a complete course in manual training demands an equipment which is somewhat expensive, making such a course practically prohibitive in the smaller cities and villages. This makes it necessary to cast about for those simpler and inexpensive exercises in hand work containing the essential elements of education by manual training, and we believe that the ingenuity and resources of our teachers are sufficient to devise plans and means whereby much of the benefit of the *well equipped* manual training school may be realized.

What are the essential benefits of manual training and what faculties and powers are brought into a high state of activity by its use?

First—To acquire manual dexterity the pupil uses his hands:

(a) To draw a design.

(b) To give the design actual material existence.

Second—To exercise his individuality: He is told to make a certain project and is left to originate his own design or pattern of the same. This develops his originality. Later he is permitted to choose a project making his own design and drawing, and perfecting the project. This becomes his own personal property.

Third—To give self-reliance and cultivate perseverance: He is asked to criticise his work as to accuracy and to re-make it until it satisfies his idea of perfection.

This list might be greatly extended by subdivision but in it are included the main benefits of manual training and we believe they may be realized to a degree in every school. To aid in such realization the suggestions following are made. We trust that wherever practicable, superintendents and principals will introduce this work into their schools with such modifications as seem necessary in each particular case.

Preliminary Exercises.

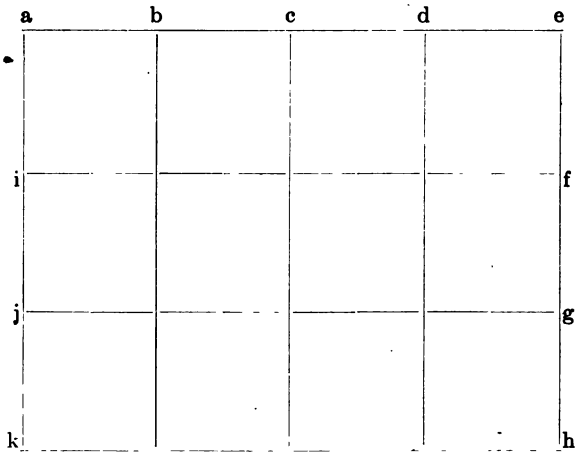
Pupils in grades below the fifth should be taught the following exercises:

1. To draw a line with a straight-edge.
2. To divide a line into given dimensions or parts.
3. To draw parallel lines with ruler.
4. To use compasses and scissors.
5. To use accurately a foot rule and yard stick with special reference to fractional parts; ½, ¼, ⅛, ½, ¼, etc.

6. To use the following measures of capacity: Pint, quart, peck, gallon.
7. To use scales in weighing sand and other material.
8. To draw to a scale (see exercise below).
9. To use hammer. Let pupils, girls as well as boys, drive nails into soft wood, then draw them and drive again.
10. To make papier maché from macerated paper.
11. To make marbles and other type forms from clay, baking them at home.
12. To design and make stained windows with colored paper.
13. To cover books with Manila paper and decorate.
14. To illustrate "Hiawatha" and other poems with cut paper.
15. To make designs with wire.
16. To perforate letters, pictures, and designs.

DRAWING TO A SCALE.

The teacher places upon the blackboard a rectangle, say there feet long and two feet wide divided and lettered as indicated below:



Then he requires the pupils to draw a similar figure upon their slates or tablets to a scale one-fourth as large. Before attempting the drawing the teacher should ascertain that the pupils understand the method by which their measurements may be determined. If they cannot do this a method might be developed something as follows:

"Teacher. As your slates are too small to make a figure as large as this upon them, you may make each corresponding line one-fourth as long. We say of such work that we draw to a scale of *four* inches to one inch.

Q. How long shall you make the lines?
A. One-fourth as long as those upon the board.
Q. What do we call such work?
A. Drawing to a scale.
Q. How long is this figure?
A. Three feet.
Q. How many inches long?
A. Three times 12 inches or 36 inches.
Q. How many inches wide is it?
A. Two times 12 inches or 24 inches.
Q. How long were you to make the lines upon your slates?
A. One-fourth as long as those upon the board.
Q. How many inches long should the figure be upon your slate?
A. One-fourth of 36 inches or 9 inches.
Q. How wide should the figure upon your slates be?
A. One-fourth of 24 inches, or 6 inches.

Teacher. Very well, draw a figure shaped like this, 9 inches long and 6 inches wide, dividing the length into four equal parts, and the breadth into three equal parts."

After the figure is properly drawn and the measurements verified by the use of the rule then might follow a series of questions, as:

1. How far from *a* to *b*?
2. How far from *a* to *e*?
3. What part of the line *ae* is the line *ab*?
4. What is $\frac{1}{3}$ of 9 inches? Prove it with the rule.
5. What is the length of the line *ak*?
6. What part of the line *ak* is the line *ai*? *ef*?
7. What is $\frac{1}{3}$ of 6 inches? Prove it with the rule.
8. How far from *a* to *b*? Prove it with the rule.
9. How far from *b* to *c*? Prove it with the rule.
10. What is the sum of $2\frac{1}{4}$ and $2\frac{1}{4}$?
11. How far from *a* to *d*?
12. How far from *a* to *e*?
13. Take the line *ad* away from the line *ae*. What is left?
14. Subtract $6\frac{3}{4}$ from 9.
15. What is the length of each of the lines *ab*, *bc*, *cd*, *de*?
16. What is their combined length?
17. What is $4x2\frac{1}{4}$? Prove it with the rule.
18. How long would the figure be if two of the divisions were taken off? Prove it with the rule.
19. Subtract $2x2\frac{1}{4}$ from 9.
20. Take one of the divisions of the length from the width. How long a line is left?
21. Subtract $2\frac{1}{4}$ from 6."

Give great variety of such questions.

Course of Study.

1. Handling, building and arranging blocks and models. Clay modeling of types.
2. Paper folding; pattern making; arranging colored paper; drawing designs.
3. Making solids in paper; making colored designs; drawing designs; weaving.
4 Decorative arrangments in colored paper rosettes; cardboard work; weaving.
5. Simple exercises with knife; cardboard solids; weaving.
6. Use of compasses in carefully constructed solids with colored paper and with cardboard.
7. Decorative arrangement with colored papers.
8. Basket making.

Paper Folding.

SUGGESTIONS.

1. Give minute directions and allow no pupil to proceed further than he has obeyed such directions.
2. Build each model from the same square.
3. After a few designs have been worked out have pupils make some original designs, giving no assistance in this work.
4. Dictate steps in folding by a uniform system and build each new model out of the "ground form."
5. Paper should be laid flat on the desk with edges perpendicular to the front and parallel to ends of the desk. All folding should be done without turning the paper, each hand being used in this work. This is important to secure the best results in hand manipulation.
6. Each pupil's design should be his own property and it should be returned to him after the "exhibit."

MODEL WORK.

Make the basis of the simpler designs the 4 in. square. Although desirable, it is not necessary to have fine paper. This work can be done if necessary with wrapping paper cut into squares.

To make irregular paper into squares:

(a) Fold paper and crease the fold.
(b) Fold creased edge upon itself.
(c) Fold again and crease so that the three folded edges will coincide.
(d) Cut off irregular part at right angles to the three folded edges.

The Square.

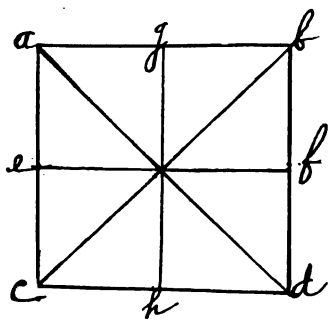


Fig. 1.

Sides: ab, cd, ac, bd.
Diameters: Vertical diameter, gh; horizontal diameter, ef; diagonals, ad, bc.

Ground Form A.

(a) Fold the diameters; crease and open.
(b) Fold the diagonals; crease and open.
(c) Fold each corner to the center and crease.
(d) Reverse without opening and fold the new corners again to the center and crease.
"Form A" shows four squares on one side and eight triangles on the other.

Ground Form B.

(a) Fold diameters; crease, and open.
(b) Fold the diagonals; crease, and open.
(c) Fold right and left edges to the vertical diameter; crease, and open.
(d) Fold upper and lower edges to the horizontal diameter; crease, and open.
(e) Fold corners to center; crease, and open.
(f) Bring middle of each edge to center, pressing each corner of the square down at center.
"Form B" shows one large square on one side and four smaller squares on the other side.

Table Cloth.

(a) Fold "Form A."
(b) Place four squares uppermost.
(c) Turn the four corners underneath out.
With the same "form" make the following:
House, wind-mill, sail boat, cup and saucer, boys' hat, general's hat. fan, etc.

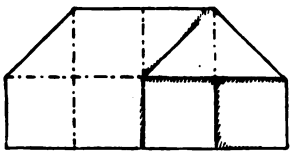


Fig. 2. House.

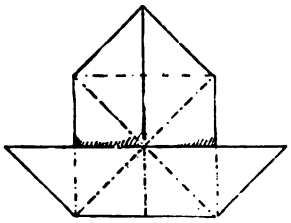


Fig. 3. Boat.

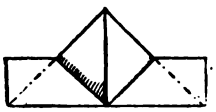


Fig. 4. Boy's Hat.

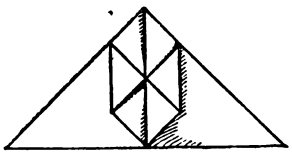


Fig. 5. General's Hat.

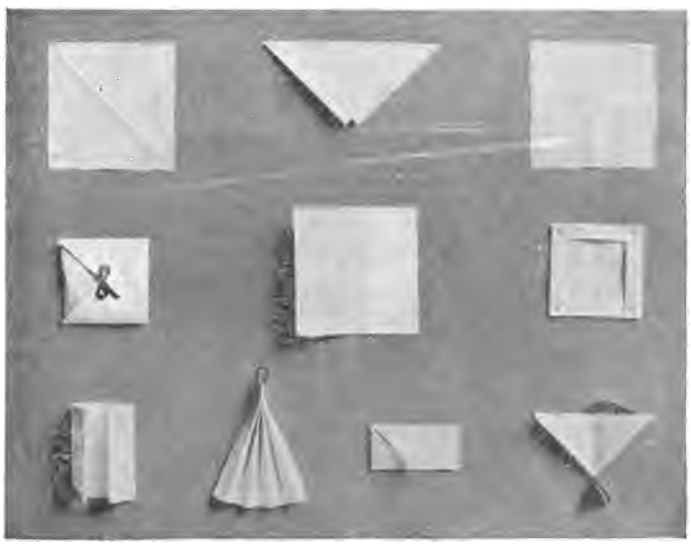


Fig. 6.

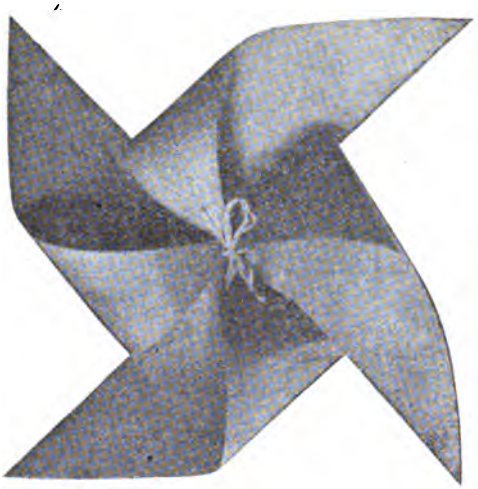


Fig. 7. Pin Wheel.

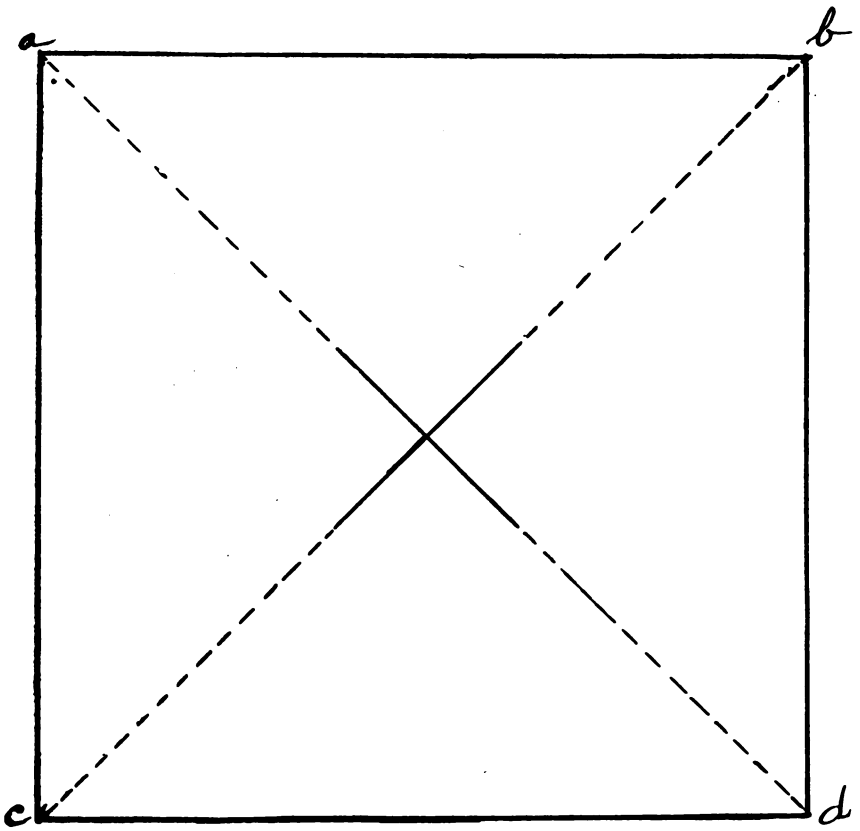


Fig. 8. Pin Wheel, Working Drawing.

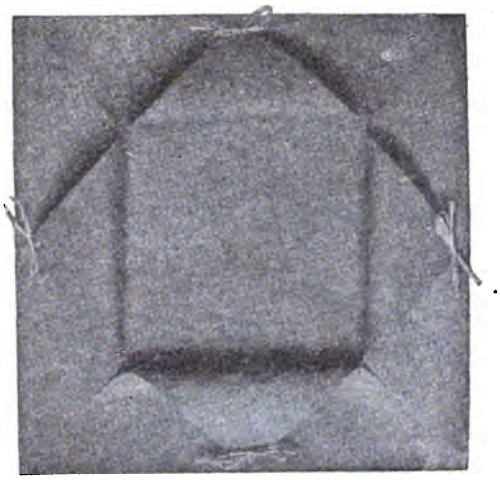


Fig. 9. Picture Frame.

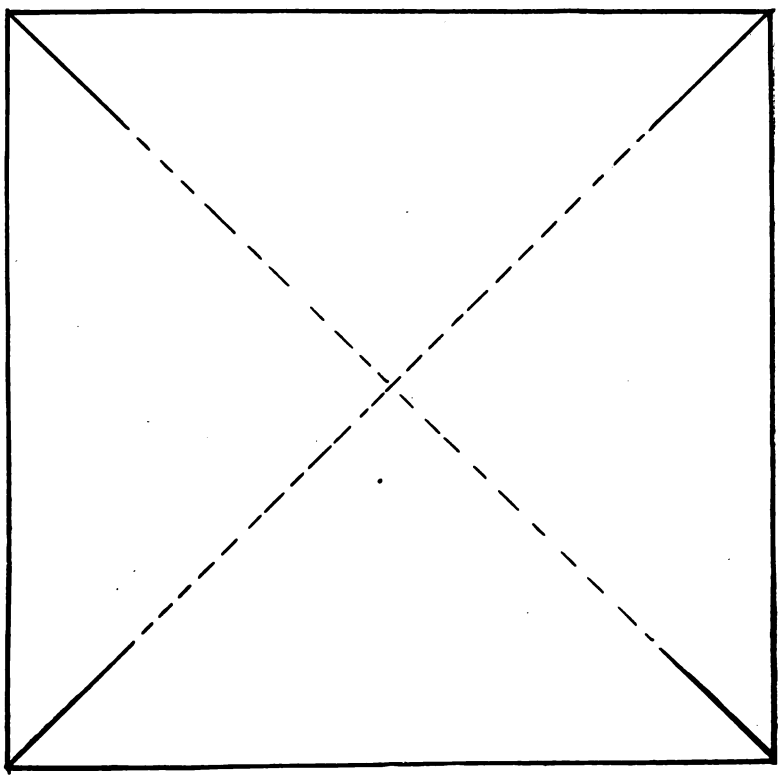


Fig. 10. Picture Frame. Working Drawing.

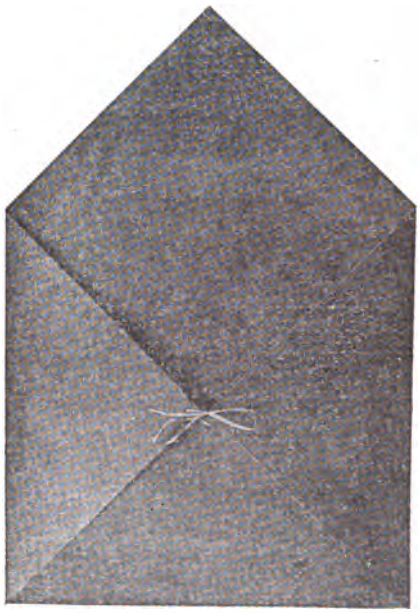


Fig. 11. Envelope.

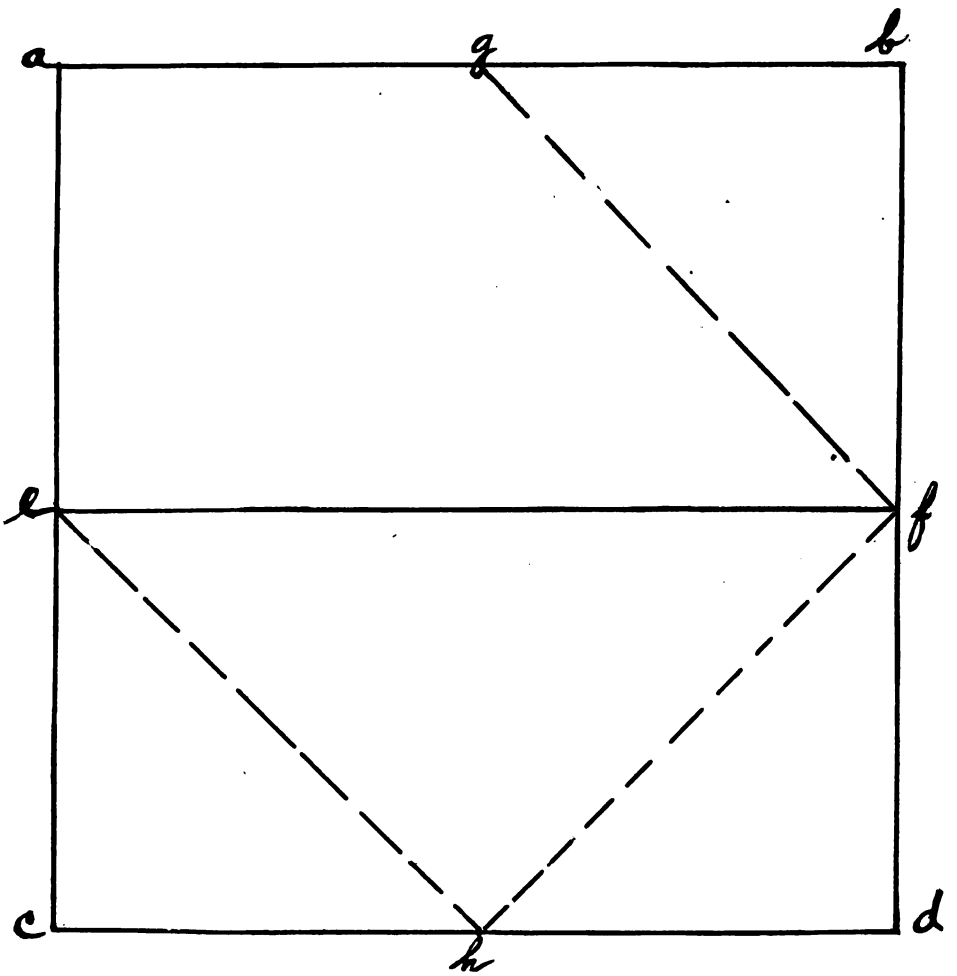


Fig. 12. Envelope. Working Drawing.

Fig. 13. Wall Pocket.

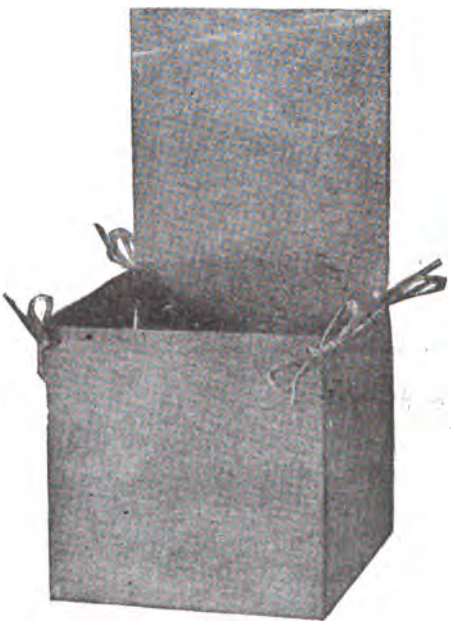


Fig. 14. Box with Cover.

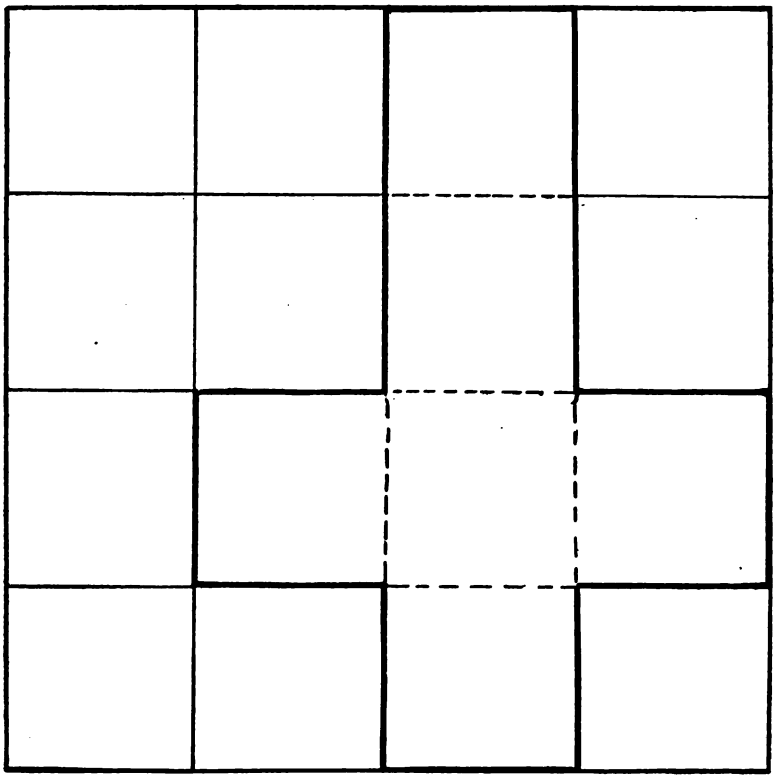


Fig. 15. Box with Cover. Working Drawing.

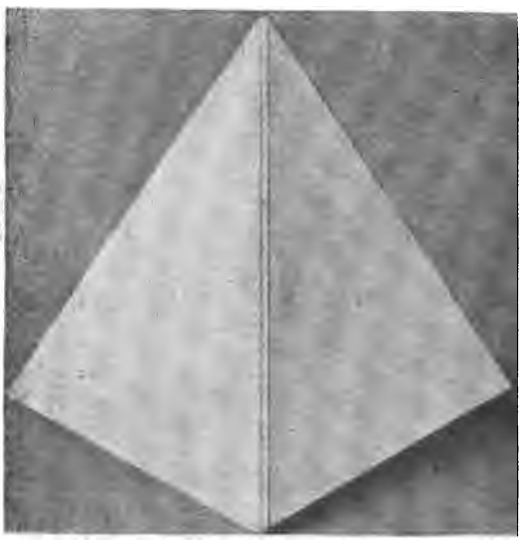


Fig. 16. Triangular Pyramid.

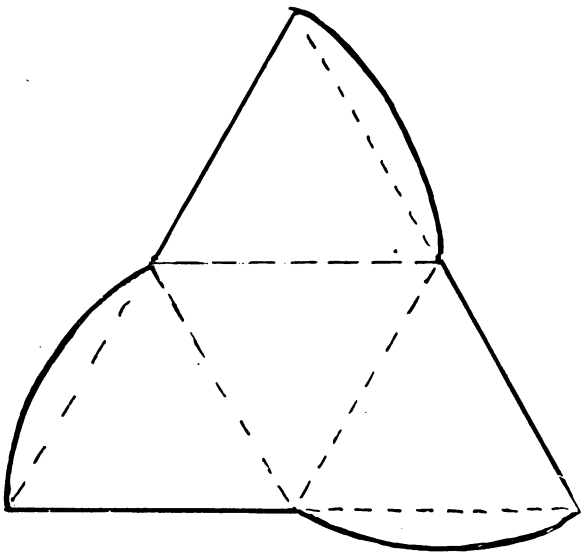


Fig. 17. Triangular Pyramid. Working Drawing.

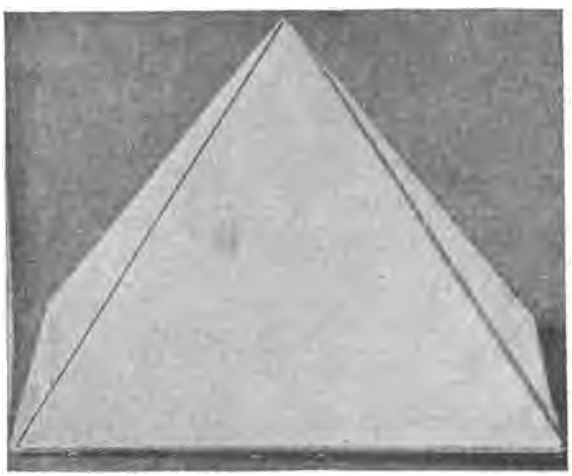


Fig. 18. Square Pyramid.

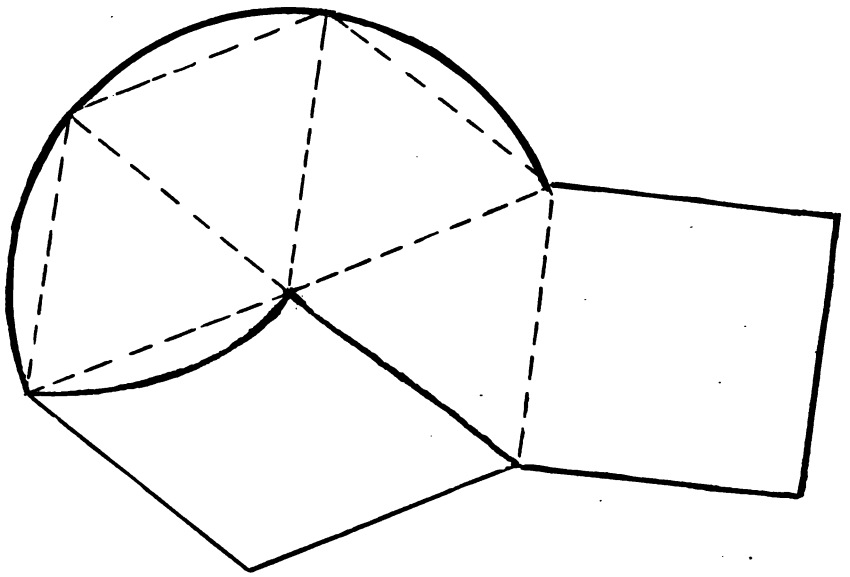


Fig. 19. Square Pyramid. Working Drawing.

Preparatory Work.

Weaving:
(a) Free hand.
(b) With hand looms.
(c) With spool.

Material:
(a) Paper, either plain or colored.
(b) Cord.
(c) Braided string.
(d) Strips of cloth, etc.

Basket Making.

In making baskets much observation work should be done. Have children study their dinner baskets and such other baskets of finer make and design as may be borrowed and brought to school. There are few things among the common place that will so soon develop respect for hand-work as baskets.

Terms:

Teach (a) spokes, and show how they support the baskets; (b) weaver (or filler).

Styles of weaving:

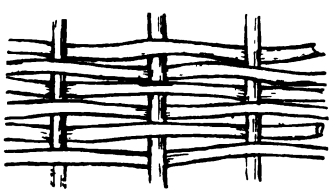


Fig. 20. Under-and-over Weaving.

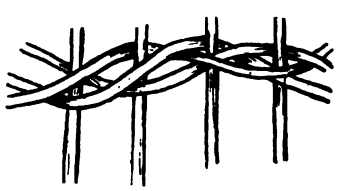


Fig. 21. Triple Twist.
Often used to finish the top of the basket.

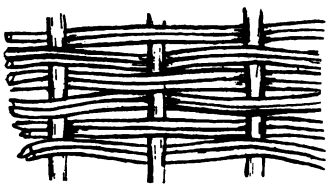


Fig. 22. Double Weaving.

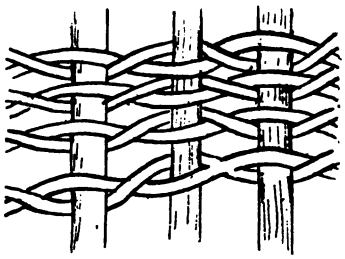


Fig. 23. Pairing.

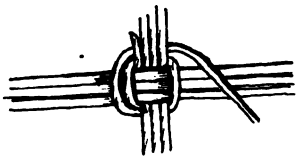


Fig. 24. Placing the Spokes.

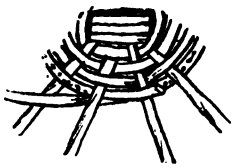


Fig. 25. Splicing.

Raffia Work.

Materials: Raffia, corn husks, rushes, paper, straw.

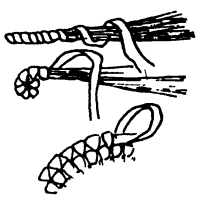


Fig. 26. Preparing Raffia for Weaving.

Raffia should be moistened before use. A needle should be threaded with one strand and the coil sewed. It can also be braided for use. This is especially true of other material.

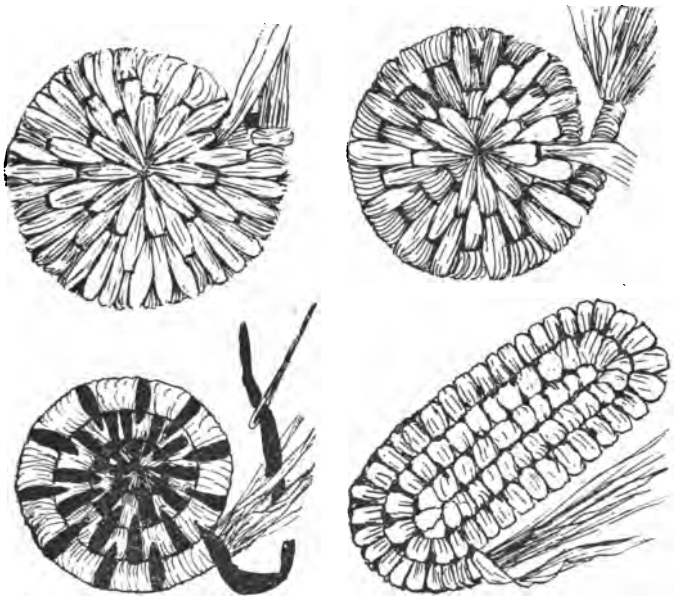
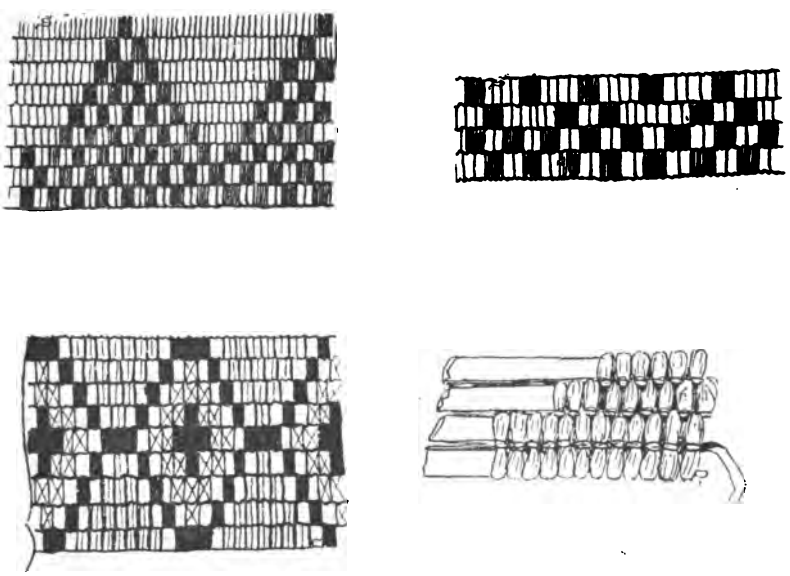


Fig. 27. How to Begin the Center.
Note carefully how the stitches pass over the two coils.



Figs. 28, 29, 30, 31. Designs in Colors.

Fig. 32. Willow Baskets.

Fig. 33. Raffia Baskets.

String Work.

1. Dividing a string into equal parts by knots.

Suggestions: Give each child a string one yard long. Let them use the string as a measure until they are perfectly familiar with the yard measure.

Have them bring the two ends together and tie a knot in the middle, making one-half a yard. Use the yard and half-yard until the pupil is familiar with the relation of each to the other.

Double the half-yard ends together and tie knots to mark the quarter yards. Use the quarter-yard, half-yard, and yard in measuring until pupils are familiar with each and their relations.

Have pupils express the various measures in feet, and the quarter-yard in inches.

Use a foot string in much the same manner until the foot and its half, and quarter are familiar both in half-feet, quarter-feet, and in inches.

2. Letter laying. Knot the string at the ends as well as in the divisions.

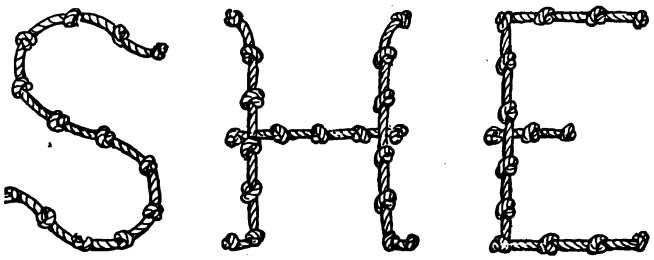


Fig. 34. Letter Laying.

Fig. 35. The Tassel.

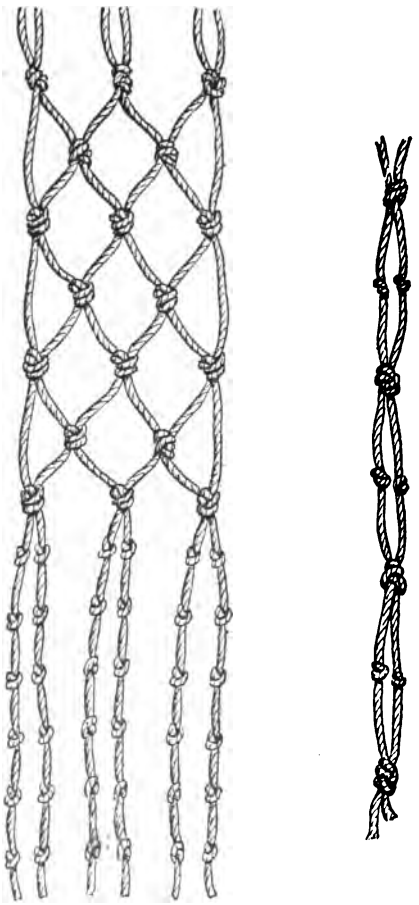


Fig. 36. Double and Single Knotting.

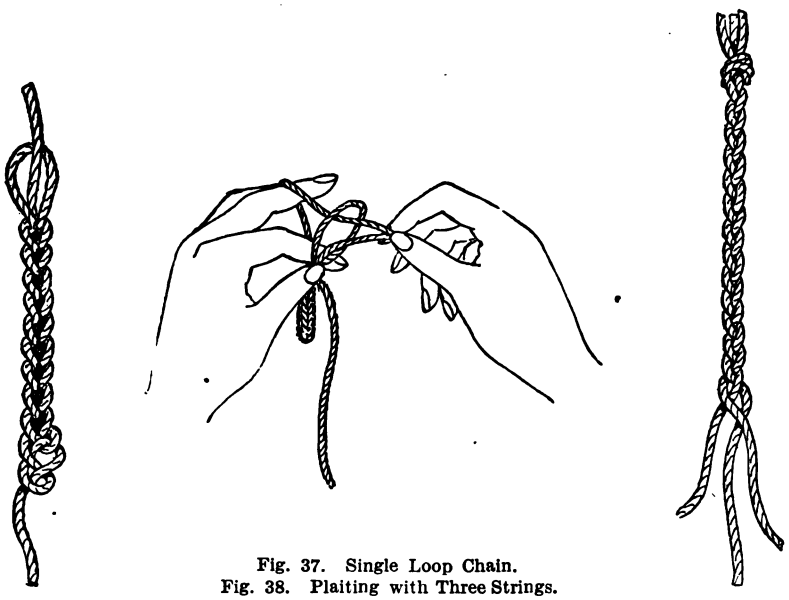


Fig. 37. Single Loop Chain.
Fig. 38. Plaiting with Three Strings.

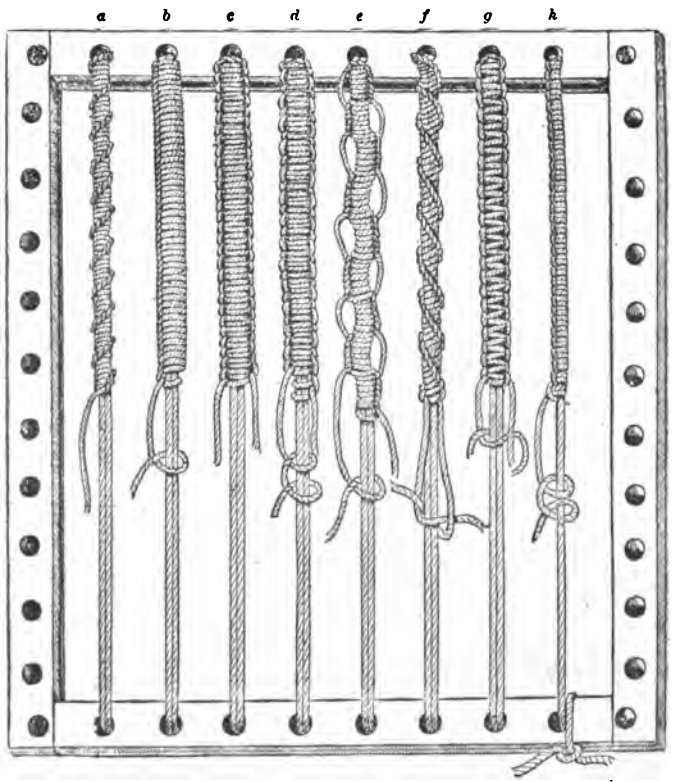


Fig. 39. Various String Exercises on Frame.
(a) Corkscrew bar. (b) Button-hole bar. (c) Single Genoese bar. (d) Double Genoese bar. (e) Shell bar. (f) Bannister bar. (g) Solomon knot bar. (h) Tatted bar.

Net Weaving.

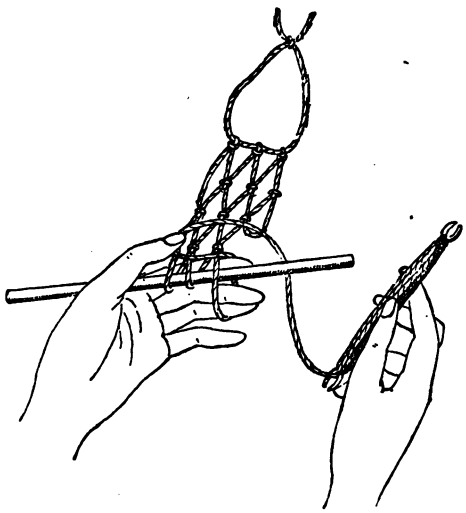


Fig. 40.

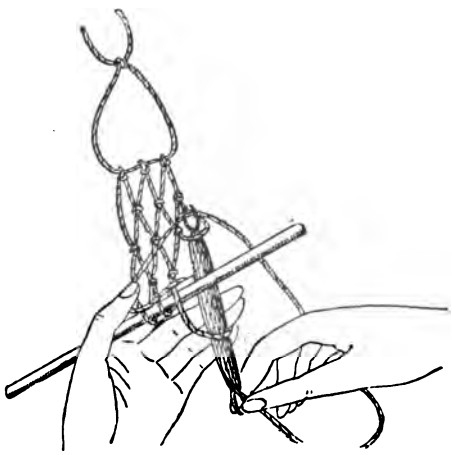


Fig. 41.

Rope Work.

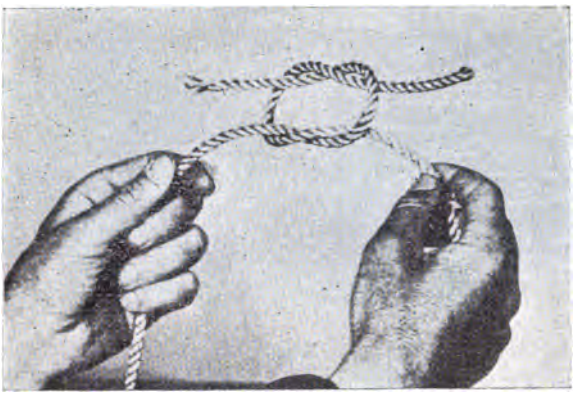


Fig. 42. Square Knot.

Fig. 43. Weaver's Knot.